Space Weather Technical Forecast

Issued on Wednesday, 27 October 2021 at 13:17 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of M-class flares.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity has been low to moderate in the 24-hour period, with several C-class flares and one M-class flare, peaking at M1.0 at 26/1557 UTC. The M-class flare originated from AR2891 rotating onto the NE limb. This region is likely to have been the source for several far-sided CMEs in the past week, as observed on coronagraph imagery. This new region is one of six on the current disc, with the others all appearing in the southern solar hemisphere. The most noteworthy of these regions remains AR2887, which appears as a Dki Beta-Gamma-Delta, although it continues to deliver smaller flares than expected for its class.
While there are numerous filaments on the disc, there is no evidence of Earth-bound CMEs in available coronagraph imagery at present.

Solar Wind / Geomagnetic Activity: The solar wind speed, as measured by DSCOVR at L1, was at ambient levels to start, but rose slightly around 26/2230 UTC to vary between 360-410 km/s. The density was mostly average at 10 ppcc or below. The IMF, Bt, was weak at 7 nT or below, with the north-south component, Bz, ranging between +5 and -4nT. The phi angle was predominantly within a negative sector (towards the Sun).

The result of the above solar wind measures was Quiet geomagnetic activity throughout, Kp 0-2.
Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured by GOES-16 was at background levels, with no solar radiation storms observed. High energy electron flux (greater than 2 MeV) was predominantly at normal background levels. Associated 24-hour electron fluence was well below the Active (1e8 integrated pfu) threshold on a steady trend, with 1.51e6 integrated pfu recorded at 27/0000 UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: C-class flares are expected, with a chance of M-class flares. This is the result of the complexity of AR2887, and the previous activity of AR2891 lying on the northeastern limb.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are expected in this forecast period. An enhancement to around 450-500 km/s is possible either later on Day 2 or early Day 3 (28-29 Oct) due to a possible connection with CH15/+. An enhancement was seen at STEREO-A which would correspond with these timings. Geomagnetic activity is expected to be mainly Quiet to Unsettled, but with a chance of Active intervals should we observe any faster solar winds on Days 2 or 3.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at background levels, with a just slightly raised risk from normal due to AR2887 and AR2891. The high energy electron flux (greater than 2MeV) is likely to be at background levels for much of the period, with a low risk of an increase towards Day 4 (30 Oct). Associated fluence is likely to stay below the Active threshold.

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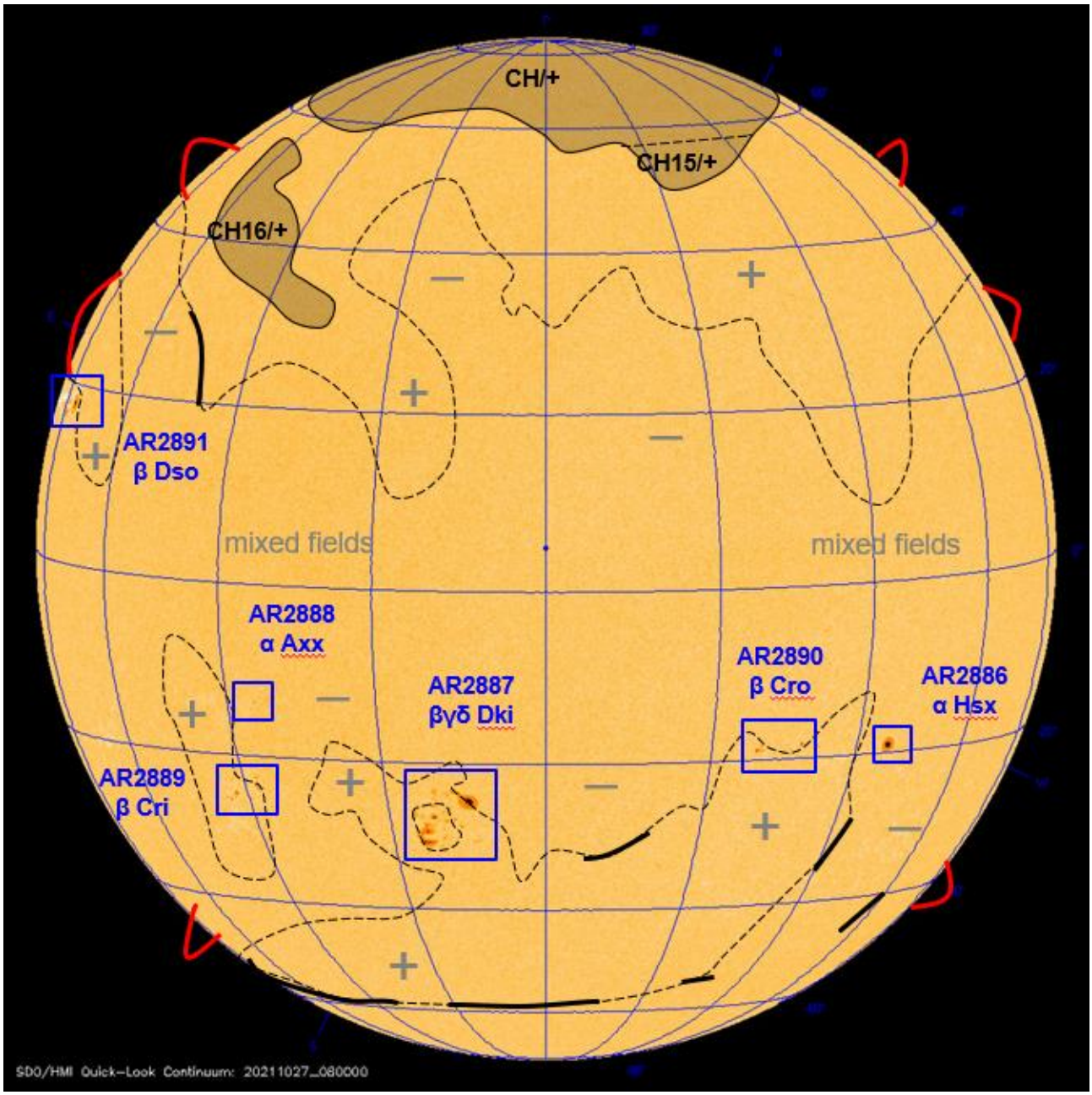
Figure 1. Solar Analysis Valid 27/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No Earth-directed CMEs feature in the current four-day forecast. There are several filaments on the visible disk, but these appear stable at the moment.
The only coronal hole in the forecast is a southern extension of the northern polar crown, CH15/+. This appears to have arrived at STEREO A, somewhat later than originally anticipated. However, STEREO A is orbiting at a slightly higher solar latitude than Earth (7N versus 5N for Earth) and ought to be (slightly) more directly in line for effects. As such it is possible that we may see a slight increase in solar wind speeds either later on Day 2 or early Day 3 (28-29 Oct) to around 450-500 km/s.
Geomagnetic activity is expected to be mainly Quiet to Unsettled, but with a chance of Active intervals should we observe any faster solar winds on Days 2 or 3.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	5	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
*	*	*	*	*	*	*

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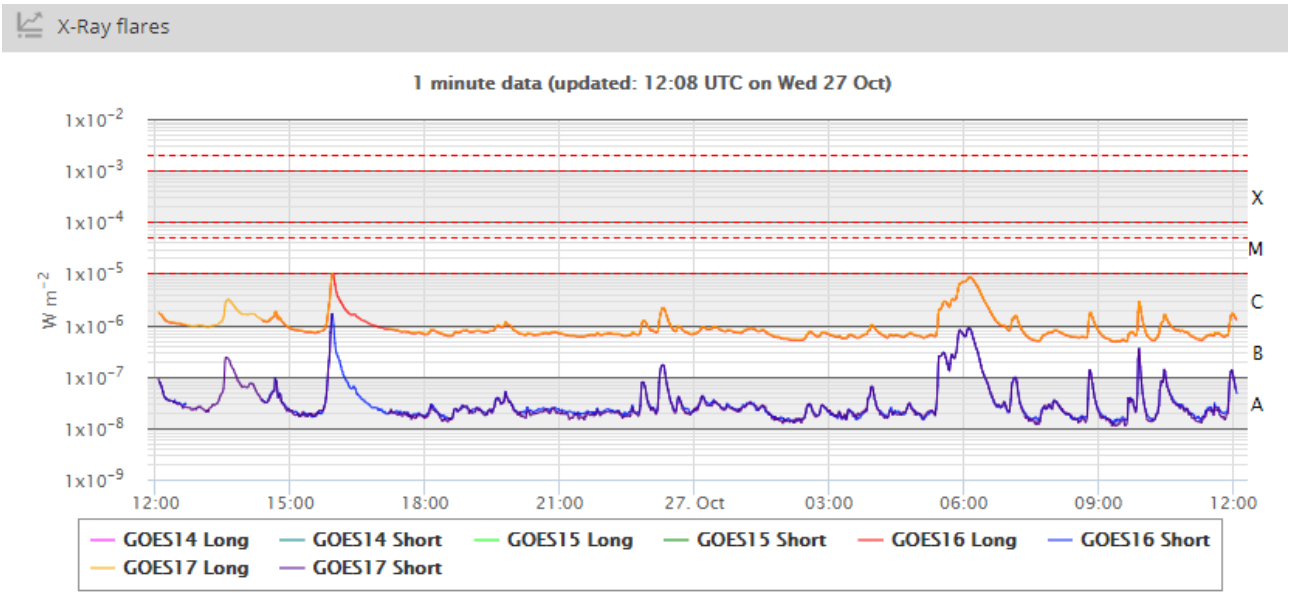
Radio Blackouts - X-Ray Flares:
The X-ray forecast and the risk of Radio Blackouts remain the most notable element of space weather at present. The solar disc has become increasingly congested, particularly in the southern solar hemisphere, which has a near-continuous train east-to-west of sunspot regions in various states of development. The most nominally threatening of these regions remains AR2887, however despite appearances this sunspot group has so far only produced some C-class flares.

The northern solar hemisphere had been quieter until the arrival of a new sunspot region, AR2891, currently on the northeast limb. This region was the source of two M-class flares on the 26th and potentially the source of some recent far-sided CMEs. The Penticton 10.7cm flux rose as this region arrived to match recent peaks (roughly a month apart) in excess of 100 sfu.
With the arrival of AR2891 the chance of further M-class flares is now at 40%, with a 90% risk of C-class flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	40	40	40	40
Very Active	R3 to R5 X Class	No	2	2	2	2

Figure 2: X-ray flares over the last 24 hours, showing an M1 flare and several C flares



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Solar Radiation Storms - (High Energy Protons):

AR2887, although so far having given only C-class flares, has the potential to give larger flares with the attendant risk of an increase in proton flux. As a result the risk of S1 has been raised very slightly above the background level to reflect this. AR2891 has already given a couple of M-class flares, so as it rotates across the disc, the risk of S1 is likely to rise.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	2	2	3	3
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

High Energy Electrons Event (≥ 2MeV):

The high energy (greater than 2 MeV) electron flux is currently at normal background levels. There is a low confidence increase in wind speeds possible on Days 2 or 3 (28-29 Oct), but it is uncertain whether this will be enough to drive a significant increase in flux levels. Any response if it does occur is likely to be into Day 4 (30 Oct). Associated fluence is unlikely to breach the Active threshold in this period, with just a very slight chance by the end of Day 4.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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